ANALYSIS OF PACKAGES COMPRISING PROGRAM D-PRIME

federal emergency management agency

December 14, 1979

Approved For Release 2009/09/01 : CIA-RDP05T00644R000501540002-8

CUMULATIVE PACKAGES COMPRISING PROGRAM D PRIME

	I	II	III	IV	V
	PAPER PLANS	SHELTERING & WARNING	RELOCATION EFFECTIVENESS	ATTACK OPERATIONS	SHELTER ENDURANCE
	($0.8B)*	($1.1B)	($1.4B)	($1.9B)	($2.3B)
1. SHELTER SURVEY	0.5	0.5			
2. NCP PLANNING	0.5	0.2	0.3		
3. SHELTER PROD. PLAN		1.0			
4. SHELTER STOCKS					1.0
5. SHELTER MANAGERS				1.0	
6. WARNING		1.0			
7. EMERG. OPS CENTERS			0.25	0.75	
8. D&C EXERCISES:			1.0		
9. RADIOLOGICAL DEF.				1.0	
10. EPI/EBS	0.25		0.75		

*SEVEN-YEAR PROGRAM COST (CUMULATIVE)

FEMA's new nuclear casualty assessment system was developed to use in civil defense program design and evaluation. It models the survival process in detail, to permit evaluation of individual program elements, such as Shelter-Manager training, and of operational sets or "packages" in terms of casualty reduction. Total survivors, uninjured survivors, and the ratio of uninjured to injured survivors are ~~all important~~ useful measures of effectiveness.

Shown above is an allocation of ten operational program elements to five packages which comprise Program D-Prime. ~~The ten program elements are those shown for Program D-Prime in the December 3, 1979 paper, Enhanced Civil Defense Program to Implement PD 41 Policies~~.

Package I, "Paper Plans", provides for developing initial crisis relocation plans (CRP's). It thus includes half the Shelter Survey element (to identify hosting facilities), half of Nuclear Civil Protection (NCP) Planning (to produce initial CRP's), and 25 percent of the Emergency Public Information/Citizen Training/Emergency Broadcast Station item.

Package II, "Sheltering and Warning", includes the second half of the Survey element (to identify upgradable structures in host areas, and best-available blast protection in risk areas), and 20 percent of NCP Planning (e.g., to identify buildings to be upgraded during a crisis, in host areas). Package II also includes detailed planning of crisis actions for Shelter Production, as well as warning.

Package III includes elements contributing primarily to "Relocation Effectiveness". These include the final 30 percent of NCP Planning (e.g., exercising of crisis relocation sub-systems, and planning for relocation by essential organizations), 25 percent of the EOC element, all of Direction and Control Exercising, and 75 percent of EPI/Citizen Training/EBS.

Package IV includes "Attack Operations" elements to reduce casualties during the in-shelter and earlier post-shelter periods. These include Shelter Manager training, 75 percent of the EOC element, and Radiological Defense.

Package V, "Shelter Endurance", includes Shelter Stocks (ventilation kits, water and sanitation containers) to permit the population to remain in shelters for at least a week, if necessary.

The remaining elements in the December 3 paper (Program Management, and R&D) are prorated among the five packages, and are included in the total costs shown.

MAJOR FACTORS CONSIDERED

CRISIS RELOCATION

- WILLINGNESS TO RELOCATE
- KNOWLEDGE OF PLANS
- FRACTION WITHOUT OWN AUTO
- AVAILABILITY OF FUEL AND TRANSPORT
- SPONTANEOUS EVACUATION
- TRAFFIC CONTROL; DISABLEMENTS
- ADVERSE WEATHER
- TIME TO CLEAR LARGE CITIES
- HOST PREPARATIONS
- LEADERSHIP AND DIRECTION

SHELTERING & WARNING

- SHELTER AVAILABILITY
- CRISIS SHELTER PRODUCTION
- SHELTER ASSIGNMENT POLICIES
- SPEED AND EXTENT OF WARNING
- WILLINGNESS TO MOVE TO SHELTER
- NUMBERS CAUGHT IN OPEN ENROUTE
- IN-SHELTER PROTECTIVE POSTURE

ATTACK EFFECTS

- ATTACK DETECTION
- SIZE, LOCATION, AND TIMING OF DETONATION
- CASUALTY FUNCTIONS
- ENTRAPMENT IN DEBRIS
- FIRE IGNITION AND SPREAD
- FALLOUT DISTRIBUTION AND DOSES

ATTACK OPERATIONS

- RESCUE CAPABILITIES
- FIRE PREVENTION AND SUPPRESSION
- SHELTER LEADERSHIP
- FALLOUT PROTECTIVE POSTURE
- D & C, RADIOLOGICAL ASSESSMENT
- REMEDIAL MOVEMENT; DECONTAMINATION
- ORGANIZATION AND COMMUNICATIONS

SHELTER ENDURANCE

- PHYSIOLOGICAL LIMITATIONS
- CLIMATIC VARIATIONS
- AVAILABILITY OF WATER AND VENTILATION

UNCERTAINTIES IN ALL THE ABOVE

Listed above are important factors considered explicitly in the new ~~model~~ casualty assessment system. The model traces the vulnerability of population groups from early in the crisis period to many weeks after attack. The model is rooted in a geographic calculation that defines the distribution of population, shelter availability, and attack effects in 2-mile grids in risk areas and 10-mile grids elsewhere.

~~There are~~ Some 30 inputs ~~required in the Population Defense Model~~ are used, such as ~~the~~ population relocated during the crisis, fraction assigned to shelter, fraction in the open when detonations occur, fraction trapped in debris, and fraction rescued.

Technical factors have been estimated by experts. Other operational and behavioral factors have been estimated by FEMA panels. Some 16,000 estimates of this kind have been made, ~~from which~~ The model generates best-estimate results together with ranges of uncertainty.

TYPICAL RESULTS

EVENT	CURRENT CAPABILITY MAINTAINED — IN EVENT: NUMBER INVOLVED (MILL)	CURRENT CAPABILITY MAINTAINED — IN EVENT: NUMBER SURVIVING (MILL)	CURRENT CAPABILITY MAINTAINED — TOTAL NUMBER OF SURVIVORS (MILL)	PROGRAM D PRIME (RELOCATED) — IN EVENT: NUMBER INVOLVED (MILL)	PROGRAM D PRIME (RELOCATED) — IN EVENT: NUMBER SURVIVING (MILL)	PROGRAM D PRIME (RELOCATED) — TOTAL NUMBER OF SURVIVORS (MILL)
ASSIGNMENTS						
AT RANDOM	80			7		
TO SHELTER	157		237	230		237
AFTER WEAPON DETONATIONS						
IN OPEN	4	2		5	4	
AT RANDOM	126	70		20	12	
IN SHELTER	107	75	147 (35)*	212	186	202 (15)*
TRAPPED BY DEBRIS	7	2	142	4	2	200
FORCED OUT BY FIRE	4	1	139	2	1	199
FORCED OUT BY LACK OF WATER	5	4	138	2	1	198
FORCED OUT BY LACK OF VENTILATION	6	5	137	5	4	197
EMERGING AT END OF SHELTER STAY	126	86	97 (34)*	190	174	181 (23)*

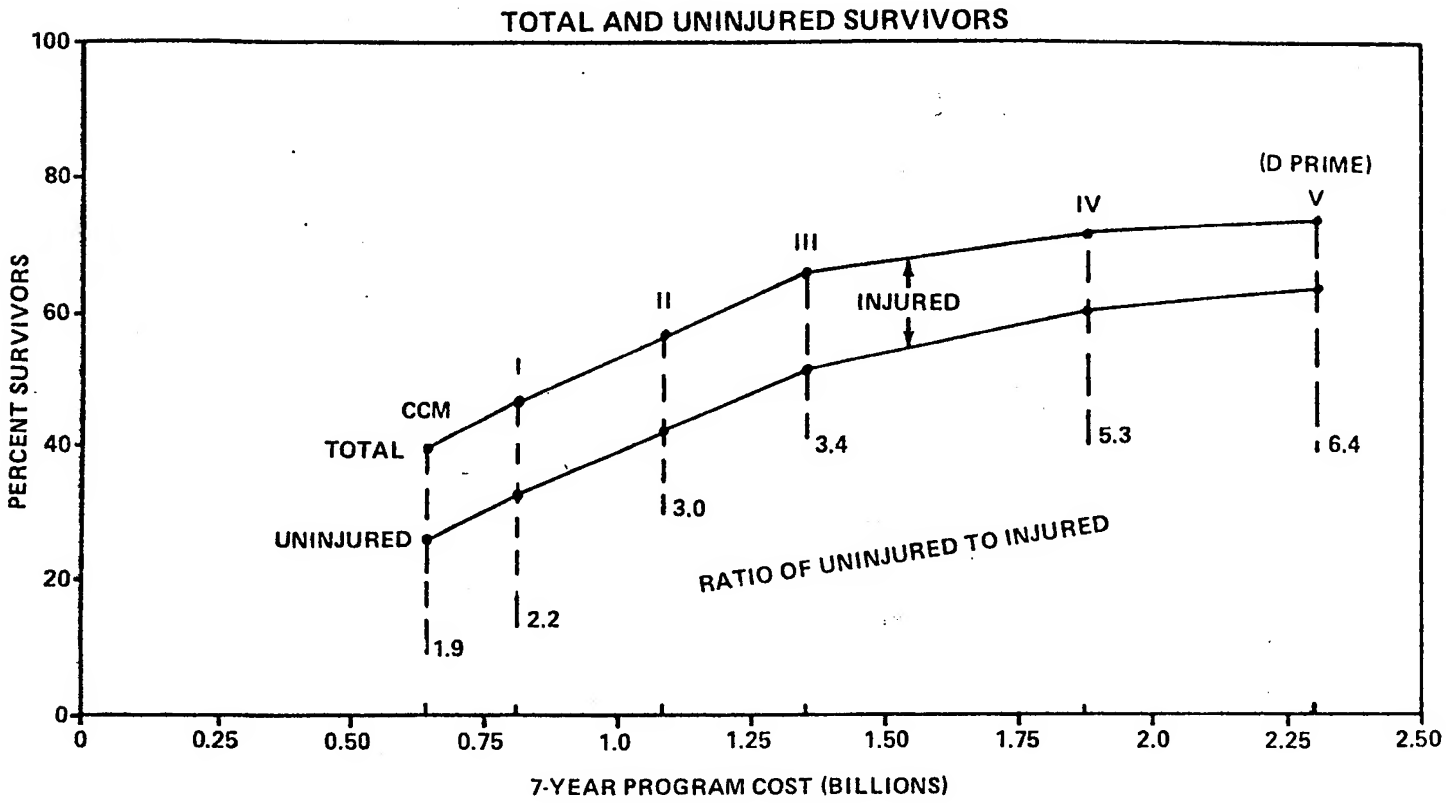
* INJURED SURVIVORS

This chart illustrates the assessment process. At the left is a series of "events" used in the model. Results are shown for the current U.S. civil defense capability (figures at the left) and for Program D-Prime (at the right). The first event is shelter assignment. The current capability maintained (CCM) until 1987 would find 80 million "at random" (in residences), whereas nearly all are provided shelter in Program D-Prime, after relocation.

At the time of detonations, CCM would find 4 million in the open enroute to shelter, 126 million at random in residences, and only 107 million in shelters. In Program D-Prime, far fewer remain at random. Survivors after detonation are based on a heavy, mid-1980's attack on military and urban industrial target employing surface detonations.

The model then follows the direct-effects survivors through additional life-threatening events in the survival scenario. CCM results in a final total of 97 million survivors, versus 181 million for Program D-Prime.

An analysis of this kind, despite the complexity of the underlying analysis, is essential to the design of efficient civil defense programs in which knowledge of how and when population losses occur is used to define the best balance of program elements. In actual analyses, survival scenarios like these are prepared for risk, host, and other areas and for each shelter class available in the area. What this summary shows is that what is achieved or not achieved in the various program elements is always reflected in the "bottom line" -- total survivors and injured survivors.



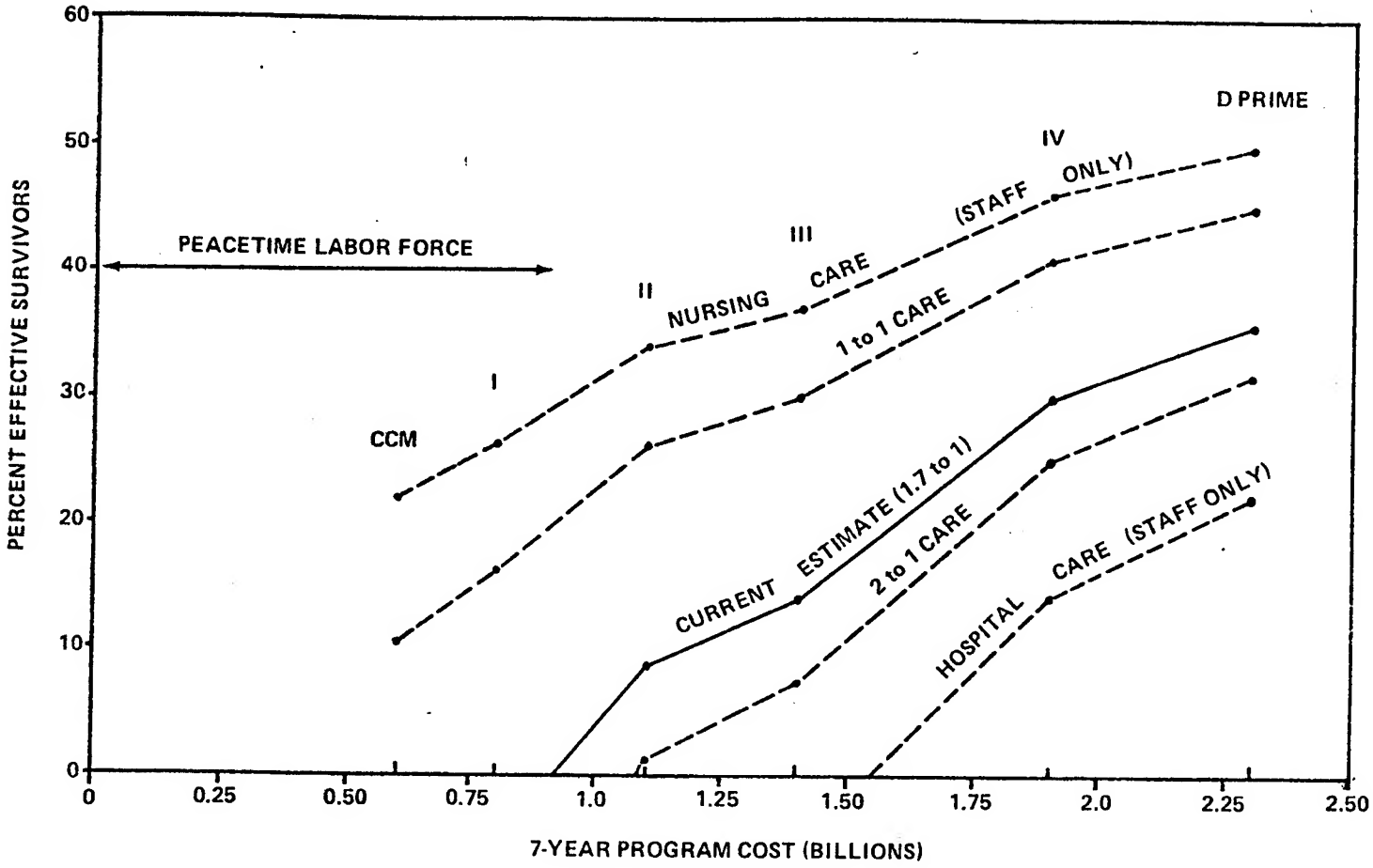
Portrayed above are results of a series of runs of the model. Expected total survivors for Current Capability Maintained (CCM) approximate 40 percent and, for D-prime (on right) about 74 percent. Between are shown the contributions of the five packages, in order of most lives saved per unit cost.

The most cost-effective addition to CCM is Package I, Paper Relocation Plans. Package II, Sheltering and Warning, is the next addition. Packages I and II together raise expected total survivors to about 57 percent, or 17 percent of the preattack population more than CCM. Package III, Relocation Effectiveness, further raises total survival by doubling the fraction of the risk population relocated in a crisis, given a Presidential directive.

The remaining packages, Attack Operations (IV) and Shelter Endurance (V), produce smaller increases in total survivors. However, they offer substantial increases in the number of uninjured survivors, and corresponding reductions in the number of injured survivors. This is shown by the virtual doubling in the ratio of uninjured to injured survivors, from 3.4 for the first three packages to 6.4 for the complete D-Prime program.

This ratio is a primary measure of recovery potential, which in turn is seen as a major factor in U.S. strategic policy. To the extent that escalation cannot be controlled, the U.S. objective is to maximize the "resultant political, economic, and military power of the United States relative to the enemy in a postwar period, in order to preclude enemy domination."

EFFECTIVE SURVIVORS

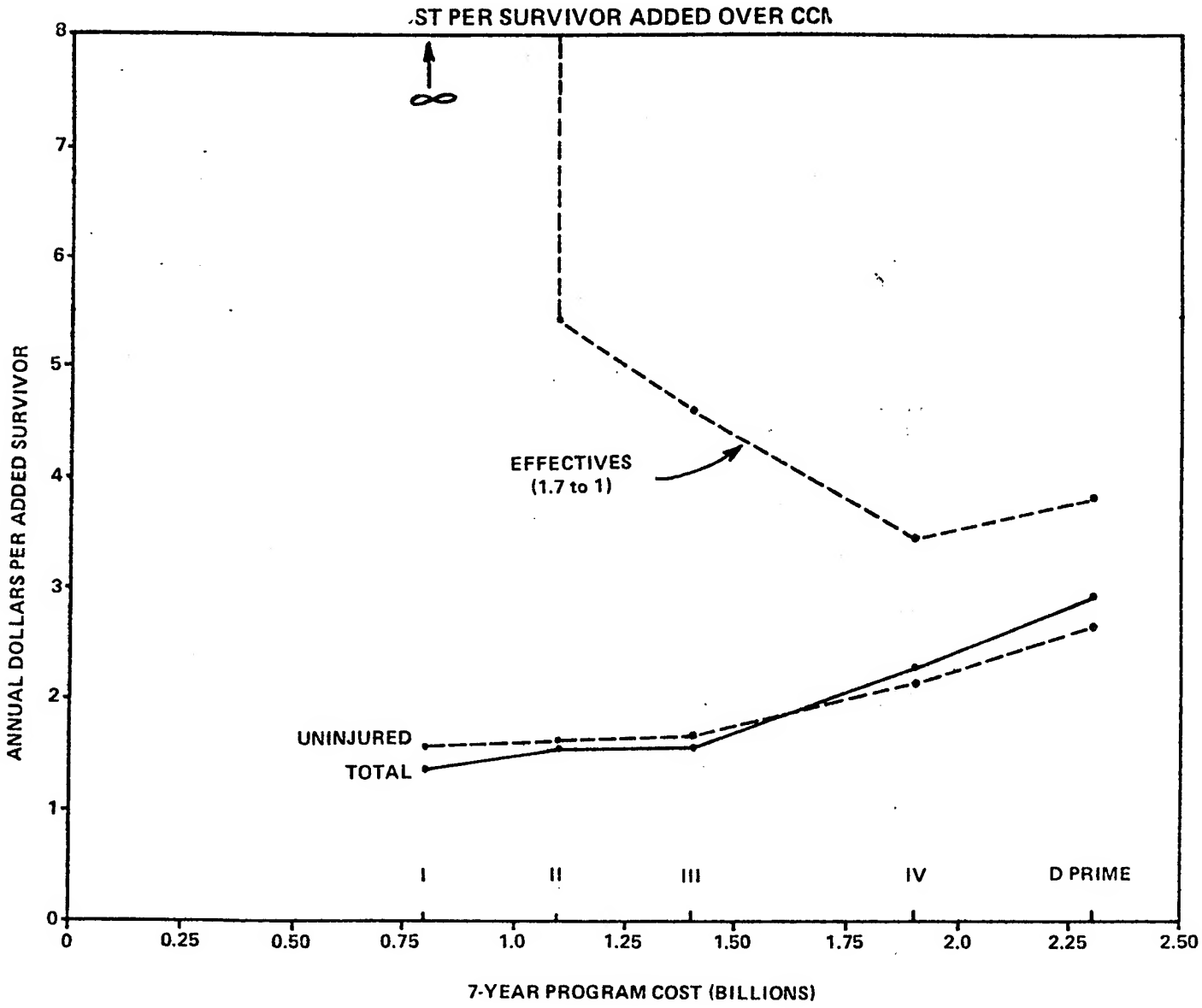


The injured survivors predicted by the new FEMA casualty assessment system are those who survive with minimal medical care more than 30 to 60 days. These surviving injured would require care by the uninjured, which would limit the number of "effective survivors" available for the recovery effort. The kind of care necessary could range from nursing-home to hospital-level care.

Shown above are estimates of survivors available for recovery, under various assumptions. These may be compared with our current peacetime labor force of about 40 percent of the population.

A substantial injured population greatly reduces the number of effective survivors, depending on the level of care needed. In addition to the institutional staff needed to care for the injured, further uninjured survivors would be required to provide food, fuel, and medical supplies for the injured. It is estimated that most of the injured would require care similar to nursing-home care. When the additional logistic support is included, the current estimate is that about 1.7 uninjured survivors would be needed to care for or to support one injured survivor.

Only Program D-Prime can provide a net recovery labor force approaching the peacetime labor force.



A final aspect of the Program D-Prime package analysis is the annual program cost per expected added survivor. Cost per survivor added over CCM is shown as a solid trend line; cost per uninjured survivor added is shown by a dashed line. Above these lines, the annual cost per effective survivor added is shown for the current estimate of 1.7 uninjured survivors needed to support each injured survivor.

Annual costs per survivor added, for total and uninjured survivors, are much the same--ranging from about $1.50 for Package I to about $2.75 for Program D-Prime. The cost per survivor added increases as more survivors are produced.

The annual cost per added effective survivor is least (under $4) for Package IV and for Program D-Prime -- which also produce the greatest number of survivors available for the recovery effort. Neither the current capability nor Package I ("Paper Relocation Plans") are predicted to produce any effective survivors. Intermediate packages add small increments of effectives at much higher costs than Program D-Prime.

It is this number of effective survivors that constitutes what is probably the most important measure of postwar recovery capability. Therefore, if we are going to undertake a meaningful civil defense effort at all, it only makes sense to aim at the Package IV or D-Prime level, in consonance with PD 41.

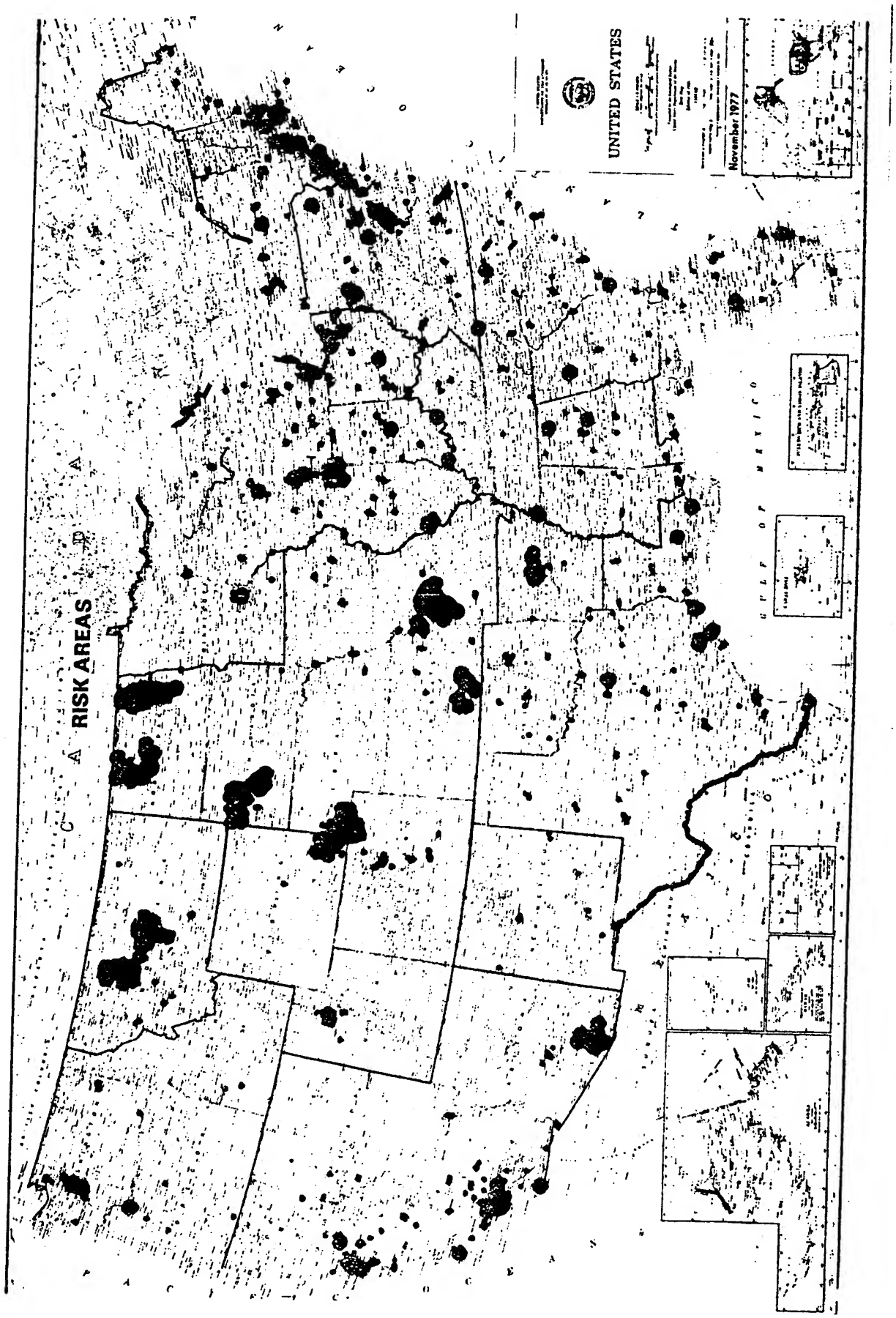
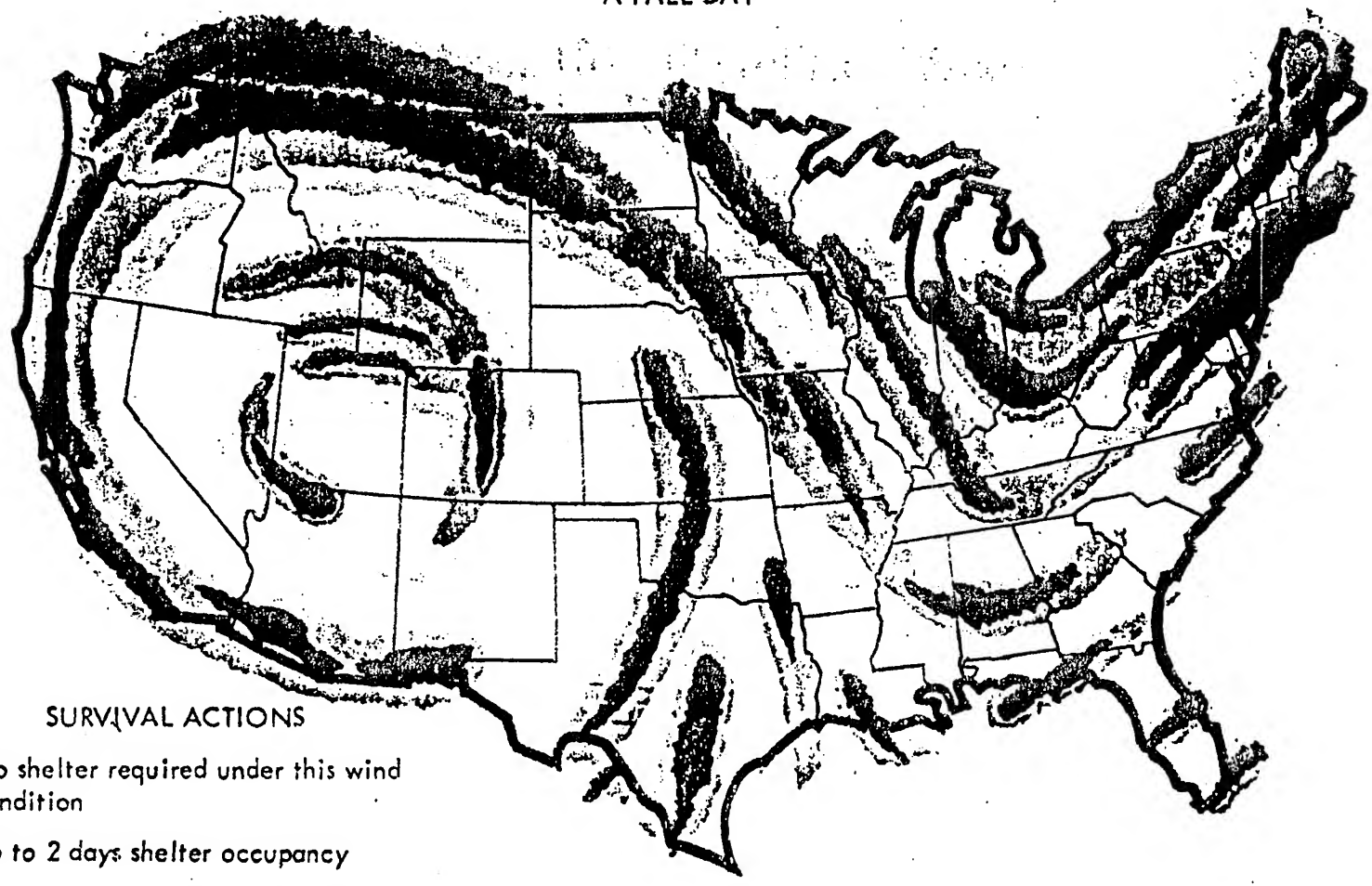


CHART 16

FALLOUT CONDITIONS FROM A RANDOM ASSUMED ATTACK AGAINST A WIDE RANGE OF TARGETS: MILITARY, INDUSTRIAL AND POPULATION

A FALL DAY



SURVIVAL ACTIONS

- No shelter required under this wind condition
- Up to 2 days shelter occupancy
- 2 days to 1 week shelter occupancy
- 1 week to 2 weeks shelter occupancy followed by decontamination in exceptional areas

CHART 17

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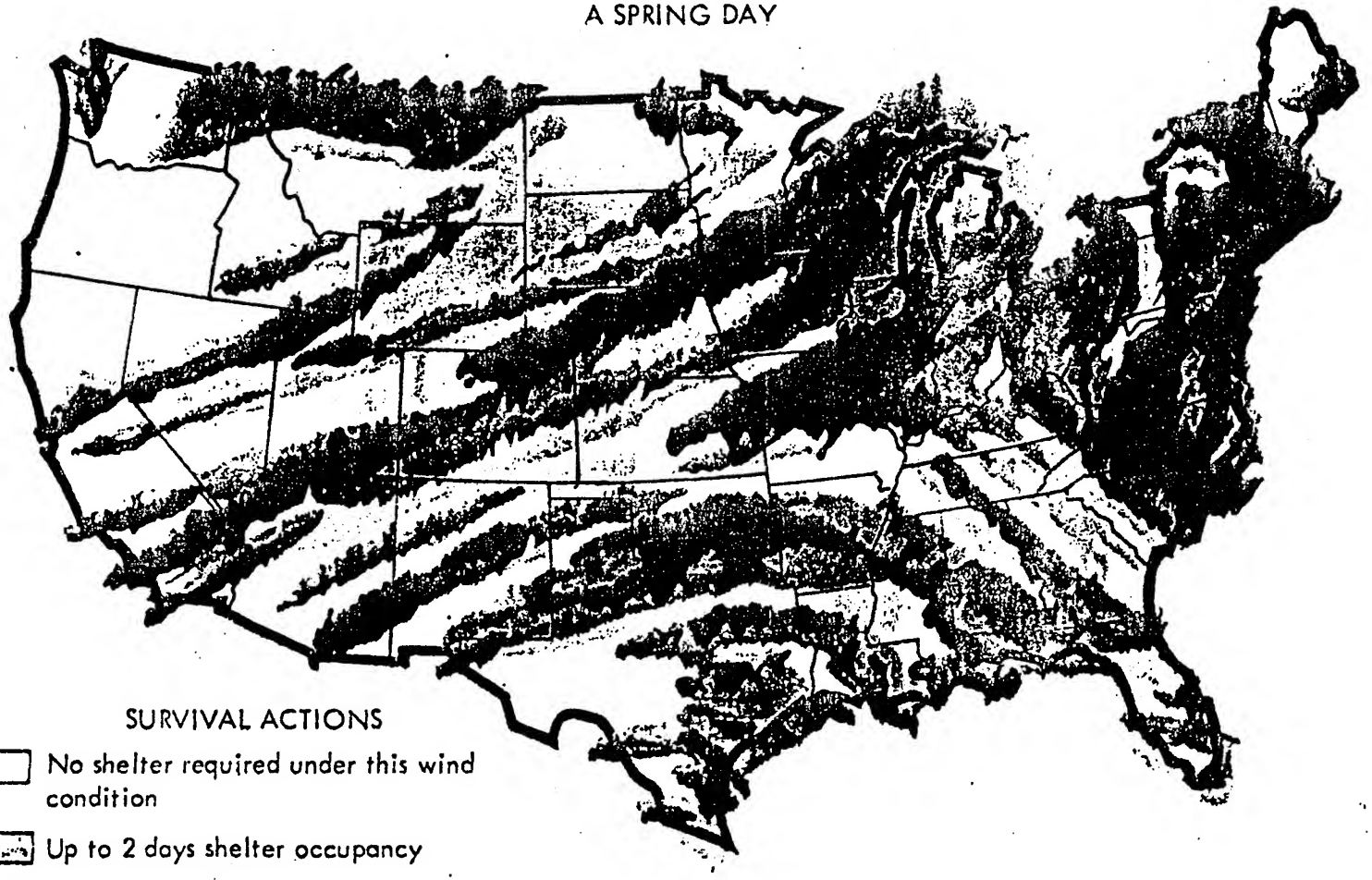
FALLOUT CONDITIONS FROM A RANDOM ASSUMED ATTACK AGAINST A WIDE RANGE OF TARGETS: MILITARY, INDUSTRIAL AND POPULATION

A SPRING DAY



SURVIVAL ACTIONS

- No shelter required under this wind condition
- Up to 2 days shelter occupancy
- 2 days to 1 week shelter occupancy
- 1 week to 2 weeks shelter occupancy followed by decontamination in exceptional areas

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U.S. — SOVIET CIVIL DEFENSE

	U·S·	USSR
Effort (full-time personnel)	5,000	100,000+
Annual investment	$100M	$2B
Blast Protection	Few Ops Ctrs	Leadership 10-20M Key Workers
Protect in:		
--Few hours	Few Ops Ctrs	Leaders & Commo
--Week	40%	90%

CHART 19

10/10/79

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SURVIVORS IN LARGE—SCALE ATTACKS

RELOCATION		1960		1985	
SOV	US	SOV	US	SOV	US
NO	NO	60%	70%	55	40%
YES	NO	—	—	90	40
YES	YES	—	—	90	80

Given U.S. superiority, Mutual Assured Destruction was enough.

But with parity, we must have relocation capability.

10/10/79

CHART 20

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CRISIS RELOCATION CONCEPT

Relocate 20-80 miles for week or two.

Families live in schools, churches, armories or w/friends.

Food distribution redirected to host areas.

Essential workers commute to cities.

Fallout protection for all.

Applicable for hurricanes, nuclear accidents, etc.

CHART 21 & 22

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